Something Free From the

# IEEE

*MITCHELL SHNIER*
Ele 79

By now, even the most 'academic' of engineers should have noticed that there is a minor revolution in progress which greatly affects, among other disciplines, electrical engineering. Yes, this is the much talked about 'microprocessor revolution. Undergraduate engineers are put into an odd position with respect to this 'revolution'. We are not given very much exposure to microprocessors nor are we given much time to explore topics such as this on our own. Ironically, as newly graduated engineers, this is one of the areas in which many new employers expect us to have a great insight. This expectation of us occurs for several reasons. An employer already into electronics has engineers who may be experienced and who may be knowledgable, but more than likely, they have not had any experience with microprocessors due to lack of time, money or interest. Often they prefer to leave that stuff to the younger engineers. Some companies are forced into electronic control systems and conveniences for their products for competitive or economic reasons. They too seek engineers with microprocessor knowledge. Many employers expect that the new graduates they hire will have a knowledge of all the newest in electronics, after all if the new graduates don't know it why should anyone else?

All of these types of employers expect that anyone they hire for the purpose of designing microprocessor based systems will have a well rounded knowledge of, and hopefully experience with microprocessors and their associated supporting hardware, software and firmware. This obviously valuable package of skills is not difficult to learn, is interesting (at least to some of us), is personally rewarding, and among other things, means a great deal to potential employers. A self motivating, responsible person who understands microprocessors enough to communicate his ideas to other engineers and laypeople(?) is an extremely valuable commodity presently. There are many people in engineering, particularly in fourth year electrical, who have taken the time to gain a better understanding of microprocessors, either as a hobby, as a means to complete or centre their thesis around or for personal interest's sake.

A series of informal, one hour talks by some of these people has been proposed. The discussions will take place at the lunch hour, once a week and will cover a wide variety of topics, encompassing both the complete design of a basic microcomputer as well as some traditional and novel uses of microprocessors. Some of the topics will be the result of fourth year theses. A few of the proposed talks are described below: 1) Rumour has it that computers only know about ones and zeros. How then does any one enter a program from a keyboard and get the results on a television. Where did all those ones and zeros go to? The talk is a basic discussion of keyboard encoders, text editors, assemblers and CRT's. 2) Direct Character Recognition. Due to the small size and great power of microprocessors today, large amounts of computing power can be concentrated in very small volumes. A problem then arises of getting the data in to and out of the thing. Traditional solutions such as kewboards and CRT's are not possible. In many situations

cont. on pg. 3


the

# CANNON

**University of Toronto Engineering Society**

January 25, 1979


## An Alternative ...

# Fibre Optics

By Professor D. E. N. Davies and Dr B. Culshaw, Department of Electronic and Electrical Engineering, University College, London

**Optical fibres are rapidly coming into service in telecommunications systems and to distribute television programmes. A new development is a system using lightweight fibres for interference-free telemetry, in which data inputs can be clipped on to the fibre without breaking into it, almost as simply as pegs may be put on to a clothes-line.**

Optical fibres are thin strands of glass or silica (quartz) which can guide light over long distances. No thicker than a human hair, they can carry information if the light travelling along them is suitably coded, for instance, by on-off modulation of the light source. The attenuation of an optical fibre has fallen dramatically over the past five years from over 40 dB/km (decibels per kilometre) to figures now typically in the regions of 1 dB/km.

People are mainly interested in optical fibres for public telephone networks. One of these tiny strands can carry thousands of telephone conversations while taking up only a very small space, so that theoretically the telephone administrations can considerably expand their facilities without have to lay new ducting under the streets. Because of this, optical-fibre technology is now one of the fastest-growing fields in electronics.

Optical fibres have several interesting properties when compared with conventional copper cables for transmitting information. A fibre does not radiate the signal it carries, nor is it affected by any local electromagnetic interference. So fibres may be freely used in areas of strong electromagnetic fields that might otherwise interfere, for instance, in ports of the electrical power industry.

This makes them useful for aircraft and satellites, too where a great deal of copper cabling has hitherto been used to shield unwanted signals rather than to transmit information; here the fibres' light weight is another advantage. Because the fibre is an electrical insulator, it does away with expensive voltage and current transformers normally needed when coupling electrical measuring instruments to high-voltage power lines. Interference problems often caused by current flowing in 'earth loops', that is, closed circuits formed by a series of earthed conductors, are also avoided when fibres are used.

**Hazards**

An optical signal travelling along a fibre, though electromagnetic, does not cause a spark when exposed to the atmosphere through a chance break in the cable. This means that optical fibres can be used in hazardous areas, for instance, in chemical and petroleum plant, without risk of fire. Such fibres are a cheap means of communicating through areas where so-called 'intrinsically safe' equipment is normally called for, without degrading performance.

The information is usually passed along the fibre by modulating a light source; that is, by impressing intelligence on it. This is done by switching the source on and off in a binary code. The source itself may be a light-emitting diode (LED) or a laser. With the former, light may be modulated only by changing its intensity. In the latter, we can still change the intensity but, because a laser is an optical equivalent of an ordinary radio transmitter (which means it is a 'coherent' or pure source), we can also put information on to an optical 'carrier' wave by varying its phase. The phase is the position of the wave in relation to its starting point. If we move all the peaks and zeros backwards or forwards along the direction in which the wave is travelling, usually by less than one wavelength, we have shifted the phase of the wave in sympathy with the information. This form of modulation can be decoded by a phase detector.

A typical transducer attached to an optical fibre. The ultrasonic pressure wave the transducer launches into the fibre imposes a linearly-related phase change on the light wave passing along it.

Being able to modulate the light by varying its phase has a number of intersting consequences which we will deal with in more detail later. But it is useful to point out that this stage that the phase of an optical signal passing along a fibre may be changed by

cont. on pg. 2

*Fibre Optics*

cont. from pg. 1

altering the length of the fibre or the temperature, or by applying mechanical pressure to the fibre. So, if the fibre carries coherent light from a laser, it is important that the modulation and detection technique for the wanted information is insensitive to such physical or environmental changes. Conversely, we may measure the changes if the detection technique is made sensitive to the phase changes they cause.

**Data Highways**

These properties of optical fibres have led to a range of applications well beyond the original idea of using them for telephone work. Interest in optical-fibre communication distribution systems is growing, and there is a plan for an optical-fibre communication network throughout a new city in Japan.

Communication and telemetry in many industrial and military applications involve the use of one-way or two-way 'data highways', which allow information to be fed in and/or received at a number of points simultaneously. A number of data highway systems now incorporate optical fibres, but the components used in optical junctions cause considerable loss of signal strength; a loss in the region of 3 dB (half the power) or more is typical. Even plugs and sockets can lose up to about 1 dB. Moreover, because it is essential to break the optical path when introducing a new data signal, it is often necessary to regenerate a new data signal from the old one at each feed-in point.

The data is usually sent around the highway in the form of a synchronized binary signal, divided into time slots corresponding to the various data sources. The information is coded by the simple on/off technique, so the sources of light may be lasers or LED's.

**Phase Modulation**

One exception to this general scheme of things is a unique form of data highway now being developed here. It offers simple, one-way telemetry from many sources to one destination, using a laser and exploiting phase modulation introduced in the fibre path by a pressure change on the fibre.

The laser used is highly coherent, with low noise. This means that the wave it produces is stable and very pure. At present we are using a gas laser, but developments in solid-state laser technology and improvements in the system will soon enable us to use a solid-state source. The output from the laser is fed into a length of multimode optical fibre, so-called because it has numerous possible paths for the rays to travel from input to out put, involving slightly different overall path lengths. Phase modulators are attached to the fibre at various input points. Each modulator operates at a distinct frequency, known as the sub-carrier or centre frequency, and is keyed on and off in pulses representing the binary code of the data. Its output modulates the wave travelling in the fibre, by shifting its phase to and fro at a rate corresponding to the sub-carrier frequency. At any instant, the phase shifts introduced by all the modulators add together, thereby producing a complex overall phase modulation that can be analyzed by receivers, at the data collection point, back into the components generated by the individual modulators. In this way data from individual modulators is identified and separated out.

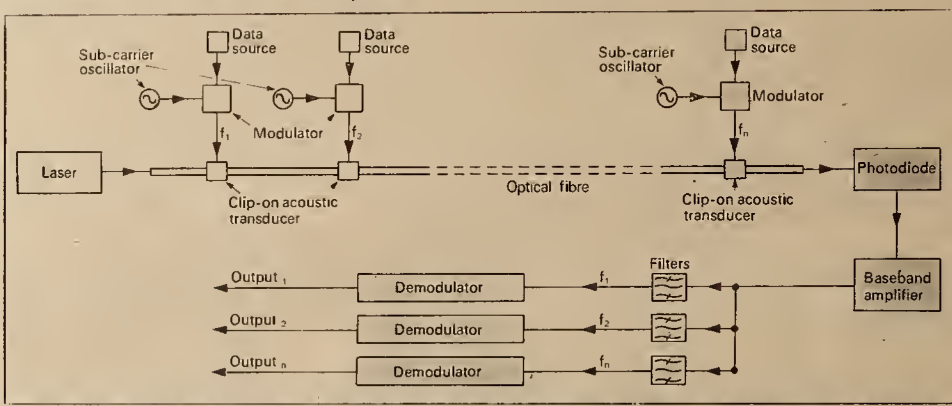
The phase modulation technique is particularly simple. An ultrasonic piezoelectric transducer is attached to the fibre and energized at its resonant frequency with the required data signal. An ultrasonic pressure wave is thereby launched into the fibre and a phase change linearly related to the pressure changes is imposed on the light passing along the fibre. This means that we modulate the light in the fibre without breaking the optical path. So a single laser source and a single fibre with no direct connectors can provide access to a very large number of data sources and carry the data to a common reception point. The associated electronics system is simple, too, for there is no need to regenerate the entire data stream. The system is, of course, restricted to feeding only one receiving terminal.

**Sensitive**

Optical fibres are extremely sensitive to these changes of pressure. To find out how sensitive a fibre is, we can induce a phase change of the sort that might be expected from a change in the fibre temperature, or from a change in the strain or in the ambient pressure, by changing the physical length of the fibre, its refractive index or its diameter. We may change one or more of these at a time, and if we measure the changes we can calculate the overall fibre sensitivity. Such calculations, supported by experiment, show that optical fibre is so sensitive that pressure variations a lot smaller than those caused by sound waves at the threshold of hearing are strong enough to give a detectable change in the optical output signal. This means that the fibres are highly microphonic; that is, they are sensitive enough to pick up ambient noise, so the sub-carrier frequencies of the modulators must be well above the upper limit of the noise spectrum, which may be as high as 50 kHz (kilohertz).

This extreme sensitivity gives the phase-modulated data highway an important advantage. It means that the ultrasonic power needed to modulate the light in the fibre is roughly proportional to the square of the bandwidth, or range of frequencies contained in the modulation. For many data signals, for example those from temperature flow rate sensors, the bandwidth is less than 1 kHz. This means that the power needed for modulation is about 100 uW (microwatts) and the power consumed by the electronic circuits to handle this is only in the milliwatt regions. So it is realistic to think of a data input station run by a battery that would have years of life. For equipment to sense data in hazardous areas, where the hardware has to be sealed in a box, without power leads, this is important. It is also an attractive feature where data has to be collected from a large number of sensors in, say, a pipeline system, where it is better not to have to distribute electrical power to the data input points. Moreover, because the optical fibres do not attenuate the signal heavily, a link could be several miles long.

We have already referred to the use of multimode fibres, in which the light follows numerous ray paths. The technique may also be used with single-made fibre, where there is only one ray path, but such fibre is very small and the mechanical tolerances at the modulator and receiver are less than 1 um (micrometre). Because of these tight tolerances, such a system is difficult to align optically, though it has the advantage of being electronically simple.




Simple one-way telemetry system from several data sources to a single destination. Each modulator operates at its own distinct frequency and the sum of their effects produces a complex overall phase modulation of the laser-produced wave in the optical fibre. The receiving system, beginning with the photodiode, uses filters to analyse the signal into its individual components corresponding to the various data inputs.

**Fading**

In multimode fibres, the multipath propogation of the light causes interference between the rays arriving at a phase-sensitive detector, somewhat akin to the fading met within short-wave radio communication, so we have to provide means of detecting the rays from the different paths separately and combining the outputs to give an acceptable level. Our team is now investigating a number of simpler, alternative systems for over-coming this problem.

Probably the most important advantage of the phase-modulated data highway is the fact that we can feed data into it wherever we like, without breaking into the optical path with a coupler. All we have to do is clip on the transducer, rather like putting a peg on a lothes-line. That, and the low power needed, is what makes it so attractive for telemetry.

# Mining for heat

*cont. from last issue.*

by Dr E.R. Oxburgh, Department of Geology and Mineralogy, University of Oxford

It follows that having high-temperature rocks is in itself not enough. They must be permeable, or their heat cannot be extracted, and there are big differences in the permeability of rocks. Some are permeable because they were formed with the spaces between their grains incompletely filled. Others crack during large-scale movements of the Earth and acquire a so-called fracture permeability, which may also be caused by thermal contraction cracks when the hot masses cool.

**Geysers**

Under favourable conditions of temperature and permeability, a natural convection system may develop spontaneously in the ground-water that normally occupies all accessible pores and cracks in the rocks below the level of the water table. Groundwater is heated near the magmatic body and rises to the surface, where it may give rise to systems of geysers of fumaroles. As the hot water rises, cool water is drawn in to take its place; at the surface, the hot water flows away and cools and eventually sinks to complete the circuit.

Where geothermal power af this kind is exoloited it is necessary to drill arrays of holes to channel the flows of hot water to the surface at convenient points and to control the re-injection of cooled water into the geothermal reservoir. There are considerable technical problems in designing and maintaining these geothermal plumbing systems. The water may be at a temperature of up to 250°C and so be able to dissolve material from the rocks, particularly silica and calcium.

This has various consequences. The water itself may become a highly corrosive fluid, particularly if it contains a lot of NaCl, $CO^2$ or $H^2SO^4$, and it reduces the life of steel pipes to less than a year. Furthermore, when it cools at the surface the various solutes precipitate and build up a thick 'fur' in the heat exchanger. In some cases there is so much precipitate that it creates a disposal probleml And it is not only pipes that may fur up. Precipitation in the upper part of the geothermal reservoir moy clog up rocks and make them impermeable. Sometimes this problem can be solved by drilling new holes in other parts of the reservoir, but in extreme cases it may put an end to economic exploitation of that part of the field.

In spite of these difficulties geothermal power stations are producing electricity in a dozen or so countries. Many plants were economically competitive with coal, oil and gas powered stations even before the rise in cost of these fuels over the last three years and they are, of course, much more so today.

The comparison with stations fired by fossil fuels is worth pursuing. Although a coal-fired station may well be situated near a mine, it will not normally depend entirely on coal from that source. If the mine fails, other coal can be obtained and the station goes on working, though the costs may be higher. But in the geothermal case, the success of the power station is directly linked to that of the geothermal field which it was built to exploit. For this reason the field must be much more thoroughly explored than a coalfield.

The main difficulty is that no two places are geologically identical, and the profitable exploitation of a geothermal reservoir depends on a thorough understanding of the permeability structure and the temperature distribution within it and surrounding it. This means long, detailed and costly studies. Even then the field may have to be abandoned as unsuitable for exploitation by existing technology.

It is clear, therefore, that in

cont. on pg. 3

*Mining for heat* cont. from pg. 2

no sense is geothermal energy free, as is occasionally suggested. There is always the serious possibility of having to abandon a project after heavy investment and, even when the plant is running, the rate of replacement of some of the equipment is very high.

We turn now to the possibilities of geothermal exploitation in places where the surface heat flux has not been abnormally increased by magmas carrying heat to the surface, and where the temperature distribution is governed largely by heat steadily conducted from below. We saw earlier that the steady heat flux in such regions is too low to be of economic interest and that some way must be found to 'mine' the heat. In principle this is not difficult. It is simply necessary to identify places where rocks at a promising temperature, say 100°C, are unusually close to the surface, and then drill down to them and extract hot water at a rate that takes into account the size of the field and the capital investment. Such fields obviously have a limited life because the extraction rate is so much greater than the natural heat flux; a geothermal field exploited over 20 years, with an initial temperature of 100°C, might yield water at only 60°C when it has to be abandoned. It would then take several thousand years for the water to heat up again. This applies also to fields exploited by convection if magmatic activity ceases.

These geothermal fields with low heat content per unit mass, known as low-enthalpy fields, may present no problem in principle but there are various practical problems. The first is to find them. They are not obvious, as are the geysers or volcanoes of magmatic regions.

Temperatures in low-enthalpy fields are related to the thermal conductivity of the rocks, K, and the overall upwards heat flux, q, by the relationship $q = KB$(where $B$ is the geothermal gradient, the rate of increase of temperature with depth). Away from plate margins, q may vary by about a factor of two, and K by a factor of five, depending on the rock type. Areas of geothermal interest will be those characterized by a high value of B, and to find this we must look for a value of q that is as large as possible and of K that is as low as possible. This really amounts to saying that if we have an insulating blanket (with low K) and beneath it a heat source (q) the temperature under the blanket will be high, and the larger the value of q the higher the temperature.

**Calculating Heat Flux**

Prospecting for low-enthalpy geothermal fields must therefore start with a study of the geology and a search for regions in which there are likely to be suitable insulators. The next step is to measure q. This is done by making very precise measurements of the temperature gradient in shallow bore holes, about 200 to 500 metres deep, and measuring in the laboratory the thermal conductivity of the core material recovered from the hole. The equation given above can then be used to calculate the heat flux. But before the flux can be used as the basis for predicting temperature at much greater depths, a variety of corrections have to be applied to take account of how the near-surface value of the thermal gradient is affected by topography, climatic changes and the movements of ground water.

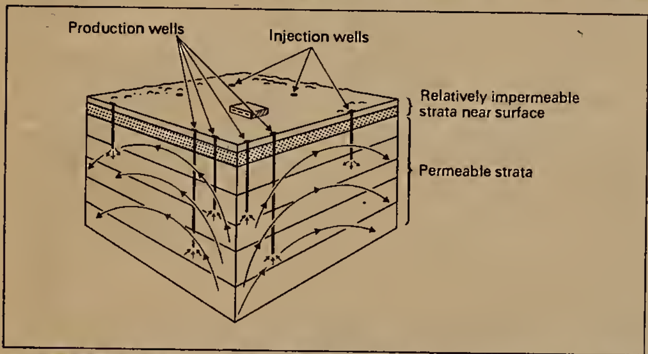
When an area of potential interest has been identified, with, say, predicted temperatures of 100°C at 3 km depth, the next task is to see whether the rocks that deep are permeable enough to allow water to circulate and extract heat. The main problem here is that low-enthalpy fields are deeper than the high-enthalpy ones, and with increasing depth the weight of the overlying rock tends to close pores and fissures and make the rocks impermeable.

Assuming that conditions of temperature and permeability are favourable, a decision to go ahead depends on the size of the accessible thermal field, which governs its total possible production, the amount of drilling that will be necessary and the potential market for the energy produced. The accompanying illustration gives some idea of drilling costs at 1976 prices: the shallower the holes, of course, the more attractive the prospect. One attraction of low-enthalpy fields is that the problems of corrosion and precipitation are much less, simply because the water is never hot enough to dissolve a lot of material from the rocks.

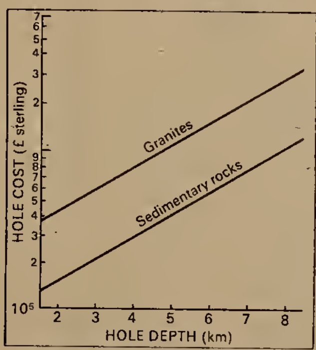
With low-enthalpy fields it is essential to have a convenient market for the low-grade heat they produce, because their water is too cool to generate electricity in conventional power plants. Although there is a considerable amount of research into heat pumps and electricity generating systems driven by small temperature differences, the main application of low-enthalpy water is direct heating, whether domestic, agricultural or industrial. For this reason, and because it costs too much to pipe hot water for long distances, the market must be within a radius of 10 to 30 km of the thermal field. One of the most recent developments of this kind is in France. In the Paris Basin, where water at about 80°C is used to heat and provide domestic hot water to blocks of flats. A small amount of electricity is used for 'topping up' in winter if necessary. This project has proved to be highly successful. There are many parts of the world where geothermal energy could be exploited in this way but decisions on whether to do so will depend on local economic circumstances, including the costs of competing fuels.

What then are the prospects for the future? From what has been said earlier it is apparent that high-enthalpy geothermal fields suitable for the generation of electricity are likely to be abundant in plate-margin regions and in many cases provide power more cheaply than coal, oil or gas. Elsewhere, low-enthalpy fields are a possibility but the economic case for them is often more finely balanced, and they could not meet the large energy needs of an industrial country. Research is, however, going on in a variety of directions which could change this. Techniques are being explored with the aim of making impermeable rocks permeable, using artificial explosions and controlled thermal contraction. Success along these lines could open up many thermal fields of high- and low-enthalpy types which cannot at present be worked. Even more important would be improvements in technology to reduce drilling costs. This would make existing low-enthalpy areas more profitable, could make more areas an economic proposition and would make exploration less expensive.

The outlook for geothermal energy should be one of guarded optimism. It is not the answer to the world's energy problems but in some regions it could be very important, and the number of such regions could grow rapidly if the technological advances were made.




In a geothermal field, hot water circulates within the permeable zone and is extracted at production wells to be piped to the power stations. After the extraction of as much as is practicable, the water (still warm) is injected back into the reservoir to be reheated. The long, curved arrows in the diagram show the natural convective circulation.




Approximate drilling costs, estimated for 1973-74. Actual costs may differ a great deal from these, depending on local circumstances. Sedimentary rocks are generally easier to penetrate than granites. The cost of a hole roughly doubles for every additional two kilometres drilled.

cont. from pg. 1

# IEEE

where portability is a major concern. Indeed, these input/outpout devices are often many times the size of the computer itself. A very compact and simple method of alphanumerikc data entry is discussed and the actual complete design of a numeric entry device is presented.

3) Design of a basic 8080 or Z-80 microcomputer. Interrupt handling, power on jump, input/output and address decoding, power supply considerations, direct memory accessing and peripheral interfacing, such as to a teletype, are discussed.

4)"My television has Bugs Bunny on it, how do computer terminals get other (alphanumeric) characters on it?" A discussion of how a cathode ray tube (CRT) terminal displays characters on its screen.

Other topics such as disk and cassette storage, assemblers and other extravaganzas can be discussed if there is sufficient interest.

The first talk is scheduled for Tuesday January 30, at 12 noon in BG8119. Further announcements will be pasted on the bulletin board between rooms GB148 and GB149.

# Gravitational Image

The Nye Optical Company of Spring Valley, California, has announced that it has successfully photographed the gravitational field around a 500-gram lead weight. The photograph was obtained by placing the weight in a recently developed gravity chamber, called GRIM-1, that is capable of forming an image of minute gravitational fields and then photographing the image with ordinary high-quality camera equipment.

The photograph is what experimenters call a near-contact gravitational field image—analogous to the optical situation that occurs when a flashlight is placed in near contact with photographic film. The validity of the phocess was confirmed in two ways: Several images of the same object agrees fairly well, and interactions between three objects produced gravitational barriers (points where the forces between the objects are in equilibrium) that roughly agreed with computed values.

The Nye Optical photograph is believed to be the first image of a near-contact gravitational field ever obtained. It is particularly significant because it is only one step removed from imaging gravity at a distance, and it may serve as the basis for the future development of gravitational optics. If gravity could be imaged at a distance, then the structure of the interior of the earth or even the interior of the sun could be mapped. "Beyond this, we look to the production of synthetic gravity and hopefully coherent synthetic gravity," Says Richard Dye, president of the Nye Optical Company. "Then the crowning achievement will be gravitational or magnetic holography. Some responsible people are even beginning to talk about the neutralization of gravitational fields."

Omni

# Engineering Society

## Coming Events

### Wednesday

| | |
|---|---|
| January 31 | Faculty Council Meeting<br>2 PM GB 202 |

### Friday

| | |
|---|---|
| February 2 | Civil and Nurses<br>Folk Pub<br>New College |

From the STORES

No textbook returns after today

### Wednesday

7 February

1:00 - 2:30 p.m.

Place: Room 3171 Medical Science Building

| Speaker | Topic |
|---|---|
| Prof. P.H. Oosthuizen<br>Department of Mechanical Engineering<br>Queen's University | "Transportation of Coal by Rail with Particular Emphasis on the Freezing Problem" |


**the CANNON** 978-5377

Associate Editors: Dana Williams, Rob Pupulin, Pete Rankin

Contributers: Craig Stevenson

the CANNON is the journal of the Engineering Society. It is run by the students in the faculty of Engineering with the intent of providing the students in Engineering with an interesting and informative newspaper. All those who would like to help with your paper are welcome to. Submissions to the CANNON are also welcomed. They should be typed. The editors reserve the right to edit letters. The office of the CANNON is located on the Third Floor, Old metro Library, 20 St. George ST., Toronto, Ontario, M5S 2E4.

Brought to you by the UofT Engineering Society


## Don't Believe Everything You Read in the Toike

*In a recent issue of that well-known paper, the Bawdy Polit'ike an article discussion SKULE NITE 7T9 erroneously listed the ticket prices. The ensuing confusion was almost as intense as a typical Chariot Race report. To set the record straight, tickets are priced as follows:*

*Wednesday, February 29 and Thursday, March 1 — $3.00*
*Friday, March 2 and Saturday, March 3 — $3.50*
*and a Special Deal— Ten or more Thursday tickets — $2.50*

*These group tickets, if purchased before February 5 are guaranteed best seats — get them through your class rep, or from Graham Skells. Tickets go on sale in the Engineering stores Monday, February 5. Get yours before Reading Week to ensure a good seat!*

***************

## How would you like to become part of this?

*The Cannon is looking for an Editorial staff for the upcoming school year. If you are at all interested in this venture, please let us know...it will be a lot of fun! This year is still young! Any assistance, contributions and so on, on upcoming issues of THE CANNON would be appreciated. We are at present looking for a Distribution Director; a job requiring use of wheels and about a half-hour's spare time on Thursday morning.*

*Anyone interested, please leave your name and other particulars in the Cannon mailbox, located on the third floor of the Old Metro Library near the stores where all the other boxes are.*

*SEE YA SOON!*

***************

### (January 10, 1979 Executive Meeting

A heart warming 22 out of 24 members of the execuive turned out resulting in an embarrassing lack of seats in Hart House's South Sitting Room.

President Yates began the meeting by announcing that the Faculty Administration has approved putting pinball machines in the engineering

**Faculty Administration gives green light to pinball machines in Caf.**

cafeteria or the Engineering Stores. This is a complete about face for the administratian which saw the dinging machines as the source of decadence. the only hurdle left for council before the flippers flip is approval by Governing Council's Community Affaires Committee. Yates reported that the reversal came after it was pointed out that the meds and the law students already have several pinball machines in their buildings.

Larry Funnell (Treasurer) introduced a set of draft by-laws on behalf of absent Karen Kennedy. Of noteworthiness in the by-laws is the creation of a standing SAC Committee which would deal with SAC. Bruce Marler (Eng Sci Club) objected to the name of this committee on the grounds that the use of the acronym SAC for an engineering committee was degrading.

Michelle Noname (First Year Pres.) announced that the first year pub made $47 profit and that the very dumb frosh who so foolishly gave his life tying to steal the cannon which was being carried by the cannoneer and was still chained to the ferocious cannon guard, had been appropriately reprimanded and tortured.

Rob anderson (executive Faculty Council Rep.) reported that key stroke, non-continuous memory, non-printing, programmable calculators would be allowed into faculty exams starting with the fall of 1979.

Tim Marion (Eng. Athletic Assoc.) told of a planned fee increase of $2 from $5 to $7 to take effect next year. This was necessary he said to replace old and broken equipment.

### January 17, 1979— Eng. Soc. Council Meeting

Two special presentations were made to council at this meeting. First Eve Paley from the U of T Career Counselling and Placement Centre outlined the services available to students at the centre and expressed a wish for better contact with the classes of engineering students. She also asked for cooperation with an employment survey which would soon be done.

**Eng Soc Council passes draft by-laws and Funnell releases Fall Budget Report**

Secondly David Jones (Undergrad Rep. on G.C.) gave a talk on the Campus as Campus Centre project. After an interesting slide show and an announcement that the project was finally going ahead, Jones told council to be wary of Governing Council and the U of T Administration which in the past had stalled and sabotaged any attempts by students to better the quality of life on campus.

The draft by-laws were passed at this meeting after only five minutes of discussion. They must now be passed by a second meeting of council and then put before the students in a referendum.

Larry Funnell released the fall budget report with the only big financial problem being the $3,497.44 net loss of the toike.

*Hubert Vogt*

***************

## APEO and your Ethics

Mr. Miro Forest of the APEO will present a talk concerning engineering ethics and bylaws, and the meaning of a P.Eng designation, on Monday January 29 from 5-6 PM, tentatively in MB 128.

All fourth year students and especially those in geological, electrical, and MMS, are invited to attend.

Mr. Forest will gladly answer questions concerning engineering professionalism and the purpose of the APEO.

Come out and discover what your $55 APEO annual dues will buy.